METAL CASTING

Project Fact Sheet

IMPROVEMENTS IN SAND MOLD/CORE TECHNOLOGY

BENEFITS

This results of this project will produce a number of benefits to improve energy efficiency, yield, and quality in metal casting operations.

Anticipated benefits include:

- Reduced metal losses associated with surface finishing
- Reduced energy consumption in surface cleaning and finishing operations
- Reduced binder requirements leading to less energy required for thermal sand reclamation
- An estimated annual energy savings of 1.49 trillion Btu by 2010

APPLICATIONS

The results from this research can be applied throughout the foundry industry. Commercialization will be almost immediate. Industrial partners will have a new set of tools to improve uniformity in molds/cores and ultimately casting surface finish and net-shape capabilities.

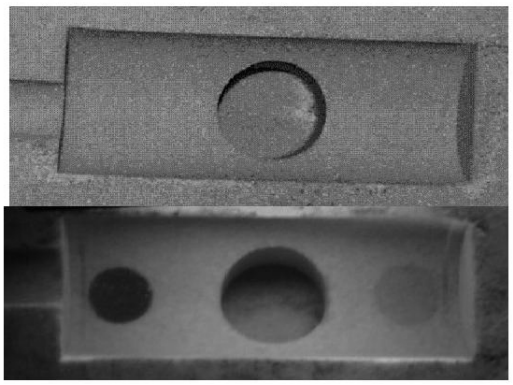
ANALYSIS OF VARIABLE DENSITY IN SAND MOLD/CORES WILL IMPROVE SURFACE FINISH OF CASTINGS

An estimated $10.5 billion in metal castings are produced each year using sand molds/cores. In spite of the size of this market, almost no quantitative information is available about density variation within the molds/cores themselves. In particular, a predictive understanding of how structure and binder content, chemistry, and mixing contribute to the final surface finish of these products does not exist.

Research being conducted by the Ohio State University, in conjunction with the American Foundry Society and industry, is examining the issues of surface finish and thermal reclamation costs resulting from the use of sand molds/cores. The results will provide an in-depth understanding of the influence of binder content on density variations that correlate to surface finish.

The results will allow metal casters to improve both casting surface finish and net shape capabilities in sand mold/core technology. This will enable metal casters to reduce time and cost associated with surface cleaning and finishing operations as well as surface finishing metal losses. It also will reduce the amount of binder used each year.

VISUALIZATION TOOL TO VIEW DENSITY GRADIENTS IN MOLDS/CORES



Upper image shows a mold containing 3 and 5% lower density areas that are normally invisible. Under certain conditions, the lower image shows that these lower density areas can be visualized. This tool will allow molds/cores to be discarded or modified before casting takes place, thus eliminating considerable cleaning room time.

Project Description

Goal: The goal of this project is to improve casting surface finish in sand mold/core technology.

Specifically, it will develop a predictive understanding of how density variations control sand structure and casting surface finish and to identify when and how this results in severe penetration. In addition, it will develop a predictive understanding of how binder content and mixing controls both density variations and surface finish. This research also will analyze the behavior of manufactured binders and binder additives at the mold-metal interface. X-Ray Computed Tomography is required to separate the performance of these organics from the effects of density variations.

Progress and Milestones

This three year project began in October 2000. Technical targets include:

1. Integration of the visualization tool into industrial practice.

2. Cross-quantification with casting finish using an optical profilometer.

3. Comparison of the surface finish produced by different binders as suggested by industrial partners.

4. A detailed study of surface finish development correlated to sand mold structure.

5. A survey of additives (both commercial and experimental) believed to improve surface finish.

6. Three presentations at annual meetings of the American Foundry Society.

Project Partners

Ohio State University
Columbus, OH

American Foundry Society
Des Plaines, IL

Alotech
Cleveland, OH

Amcast Industrial Corporation
Dayton, OH

Edison Materials Technology Center
(EMTEC)
Dayton, OH

Humtown Products
Columbiana, OH

Ross Aluminum Foundries
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January 2001